Abs Jour : Ref Zhur - Khimiya, No 8, 1957, 26416

ference between the densities of both the phases. It is surmised that at these frequencies, the formation of chains is impeded by the inertion of macroscopic drops and that the observed temporal dependence is connected only with the sedimentation. ϵ of water and NaCl solution emulsions in fuel oil of high viscosity is constant in ultrahigh frequency fields during 4 to 5 hours.

68185

24.2110 SOV/58-59-5-10842

Translation from: Referativnyy Zhurnal Fizika, 1959, Nr 5, p 134 (USSR)

AUTHOR: Fradkina, E.M.

TITLE: Method for Measuring the Dielectric Constant of Conducting Liquids in VHF Fields

PERIODICAL: V sb.: Fiz. dielektrikov. Moscow, AS USSR, 1958, pp 153 - 157

ABSTRACT: The author proposes a method for measuring the dielectric constant ε of conducting liquids at VHF, in which negative shifts do not occur. The designed measuring condenser differs from the usual type in that direct contact between the electrodes and the investigated liquid is eliminated. In this condenser the electrodes (round Pt-disks 3.5 mm in diameter) are wholly founded in the glass walls of the flask. The author provides calibration curves for the improved condenser. The relative error of determining ε in conducting liquids does not exceed 1% for substances with $\varepsilon \leq 10$, 2% for water, and 10% for substances with $\varepsilon > 300$. In the author's opinion, measurement accuracy can be

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SOV/58-59-5-10842

Method for Measuring the Dielectric Constant of Conducting Liquids in VHF Fields

increased by increasing the number of standard liquids used for the calibration curve, and by increasing the power of the oscillation generator. (Mosk. aviatsionnyy in-t im. S. Ordzhonikidze, USSR).

V.V. Krasnopevtsev

Card 2/2

АВТОРЫ: Odelevskiy, V. I., Tonkonogov, M. P., 48-22-3-11/30
Fradkina, E. M., Skanavi, G. I., Borgardt, A. A.

TITLE: Discussions on the Report Submitted by A. A. Borgardt (Preniya po dokladu A. A. Borgardt)

PERIODICAL: Izvestiya Akademii Nauk SSSR, Seriya Fizicheskaya, 1958 Vol. 22, Nr 3, pp. 273-275 (USSR)

ABSTRACT: V. I. Odelevskiy is of the opinion that the theory developed by Debye, which was introduced in 1935, was contested by Ansel'm already at that time. Since then the attempt has repeatedly been made to improve this insufficient theory. The lecture delivered by Borgardt was also devoted to this subject. The fundamental error of this theory with all its modifications (Ref 1,4 to 6) consists in the wrong idea formed of the influence of the so-called "molecular field" on dipole-polarization. The "inner field" and the energy U influence polarization: The higher U is, the lower is the corresponding polarization. However, the polarization of the elastic rotation of the dipoles in comparison with normal thermal orientational polarization is extremely low and forms only a fraction of a per cent of the latter. The confusion of these two kinds of polarization caused the errors committ-

Card 1/3

ed by Debye and his successors. The complication and "perfection" of the calculation-apparatus of the theory dealt with does not alter the fact in the works by Borgardt and Finkel'shteyn that the physical conceptions on which the theory is based are wrong and that the theory itself is consequently wrong, too. M. P. Tonkonogov says that a difference should be made between the raising of the problem by Borgardt which is absolutely correct, and the solution which represents an extremely rough approximation. Borgardt solves the problem of the calculation of the molecular field more logically and rigorosly than Ansel'm. There is no reason, therefore, to reproach the author for any incorrectness in raising the problem. The solution of the problem is, however, very poor. Yet it is valuable that the calculation of the dielectric constant contains no undetermined parameters.- E. M. Fradkina says that she raises no objection against the theory developed by Borgardt. Concerning the criticism by Odelevskiy, she is of the opinion that the latter believes that the theory developed by Kirkvud is the only correct one. G. I. Skanavi says: The criticism by Odelevskiy is based on the firm conviction that th interaction of molecules cannot change their polarizability. This does not seem to be fully substantiated. A. A. Borgardt: The assertion based on the work by

Discussions on the Report Submitted by A. A. Borgardt 48-22-3-11/30

Ansel'm (Ref 2) that the new theory developed by Debye is completely wrong, does not correspond with facts. When carefully reading the work by Ansel'm it may be realized that he has not criticized the conception of theinner field in itself but only the assumption of its isotropy. Other works (Ref 4 to 6) are just based on the variant of the theory developed by Debye, improved by Ansel'm. The model referred to by Odelevskiy, has, according to the author's opinion, no immediate relation with the discussed problem. He says that the effect of the inner field on the polarization of a dipole-matter is the consequence of a " stochastic" model and of elementary electro-dynamical conceptions. As to the theory developed by Kirkvud, theinner field really is lacking. An effective dipole-moment, which deals with the same conceptions from another standpoint, exists however. The advantage of our theory, the lecturer says, consists in the lack of random parameters which are found in the theory developed by Kirkvud. There are 1 figure, and 7 references, 6 of which are Soviet.

AVAILABLE: Library of Congress

Card 3/3 1. Gases--Polarization 2. Liquids--Polarization

20919
S/057/61/031/003/003/019
B125/B202

26.2321

AUTHORS: Fradkina, E. M. and Kozyukov, A. V.

TITLE: Turbulent flow in a conductive liquid under the effect of electrodynamic forces

PERIODICAL: Zhurnal tekhnicheskoy fiziki, v. 31, no. 3, 1961, 283-285

TEXT: The authors studied the flow of a concentrated blue vitriol solution under the effect of an ampère force in a device designated as "Gomopolyarnik". M. F. Shirokov and Ye. P. Vaulin made a generalization of the semi-empirical theory of turbulent flow in cylindrical Karmán-Nusselt tubes to the turbulent flow of an incompressible liquid in the Gomopolyarnik. A concentrated solution of blue vitriol (density 1.1) was filled into a copper vessel with coaxial cylindrical walls which served as electrodes. The radii of the cathode and the anode were $r_k = 4.3$ and $r_a = 7.3$ cm, respectively; the height of the liquid was $h = 16$ cm. This liquid was contained in an electromagnet which produced a sufficiently homogeneous axial magnetic field (290 to 1730 oersteds). The velocity of the liquid which was caused to rotate by the ampère force in the crossed electric

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and magnetic fields was measured by means of a Pitot tube connected with a micromanometer. During this measurement also the viscosity of the liquid was changed as a result of its strong heating. For this reason also the temperature dependence of the viscosity of the liquid concerned was studied by means of a Pinkevich-Mitrofanova micrometer. The results of these measurements are illustrated in Fig. 1. The Reynold's number was 6000 to 60000 in the experiments. The following expression holds for the theoretical curves:

$$\log v = \frac{4}{7}\log I + \frac{4}{7}\log H - \frac{4}{7}\log\left(\frac{0.33\sigma\rho^{3/4}S_k\eta^{1/4}}{2d^{5/4}}\right) \quad (2)$$

where $I = j_k$; H denotes the magnetic field strength, d - the width of the tube, R - Reynold's number, A a constant depending on the ratio of the radii r_1 and r_2 of the cylinder walls which contained also the universal constant $a = 0.1493$. For a turbulent flow the experimental and the theoretical results agree to within at least 6 %. These results differ, however, from those obtained for the theoretical curves described by

$$\log v = \log i + \log H + \log B \quad (3)$$

with

Turbulent flow in a conductive...

$$B = \frac{r\left(1-\frac{r_k^2}{r^2}\right)\frac{\ln\frac{r_a}{r_k}}{1-\frac{r_k^2}{r_a^2}} - \ln\frac{r}{r_k}}{4\pi ch\eta}.$$

This could be expected since Eq. (3) was obtained by taking the logarithm of the equation

$$v = \frac{IH}{4\pi ch\eta}\left[r\left(\lambda - \frac{r_k^2}{r^2}\right)\frac{\ln\frac{r_a}{r_k}}{1-\frac{r_k^2}{r_a^2}} - \ln\frac{r}{r_k}\right]$$

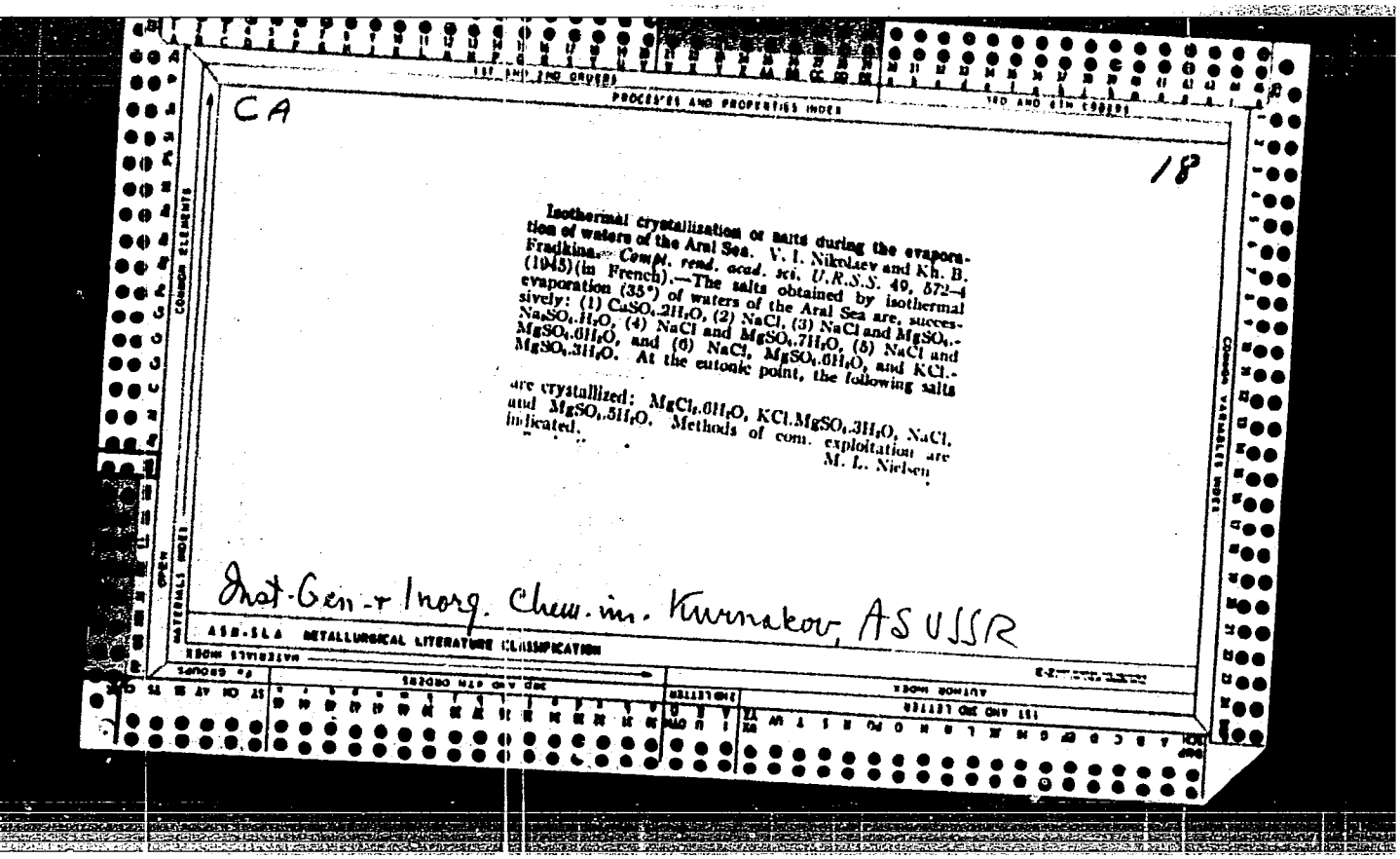
by G. A. Gordeyev and A. M. Gubanov (ZhTF, XXVIII, 2046, 1958) for the velocity of a laminar flow v at a point which is at a distance r from the axis of the device. There are 3 figures and 4 references: 3 Soviet-bloc and 1 non-Soviet-bloc. The reference to the English-language publication reads as follows: W. R. Baker a. S. A. Colgate. Second United Nations International Conference on the Peaceful Uses of Atomic Energy, 18 July, 1958.

Card 3/4

NOVIKOV, A.S.; GALIL-OGLY, F.A.; FRADKINA, F.Ye.; SUKHOTINA, T.M.; FOMINA, L.G.

Technological properties of rubber compounds based on the ethylene-propylene synthetic rubber and technical characteristics of their vulcanizates. Kauch.i rez. 21 no.7:1-5 Jl '62. (MIRA 15:7)

1. Nauchno-issledovatel'skiy institut rezinovoy promyshlennosti.
(Rubber, Synthetic)



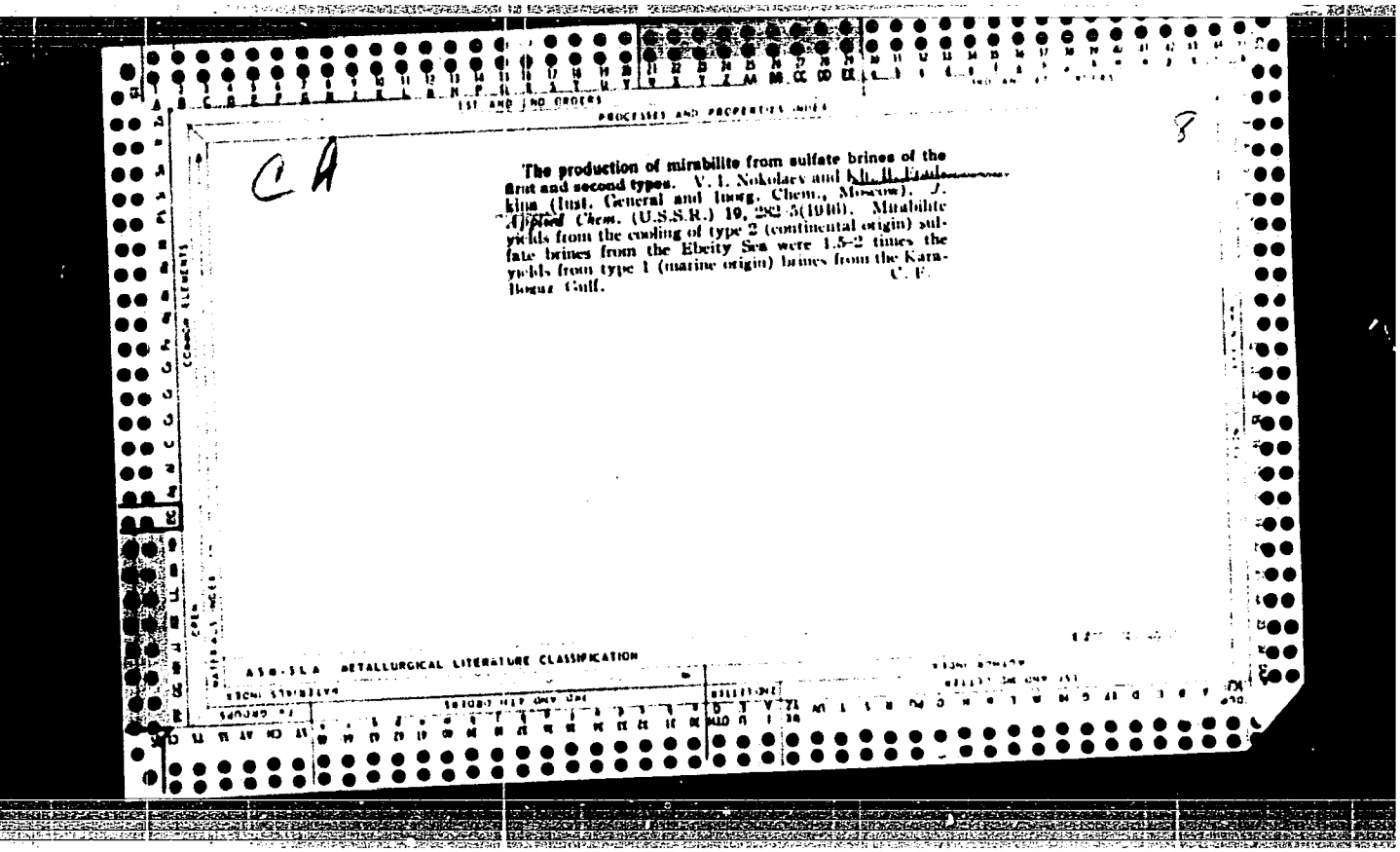
CA

18

Isothermal crystallization of salts during the evaporation of waters of the Aral Sea. V. I. Nikolaev and Kh. B. Fradkina. *Compt. rend. acad. sci. U.R.S.S.* 49, 572–4 (1945)(in French).—The salts obtained by isothermal evaporation (35°) of waters of the Aral Sea are, successively: (1) $CaSO_4.2H_2O$, (2) NaCl, (3) NaCl and $MgSO_4.7H_2O$, (4) NaCl and $MgSO_4.7H_2O$, (5) NaCl and $MgSO_4.6H_2O$, and (6) NaCl, $MgSO_4.6H_2O$, and KCl.-$MgSO_4.3H_2O$. At the eutonic point, the following salts are crystallized: $MgCl_2.6H_2O$, $KCl.MgSO_4.3H_2O$, NaCl, and $MgSO_4.5H_2O$. Methods of com. exploitation are indicated.

M. L. Nielsen

Inst. Gen. + Inorg. Chem. im. Kurnakov, AS USSR

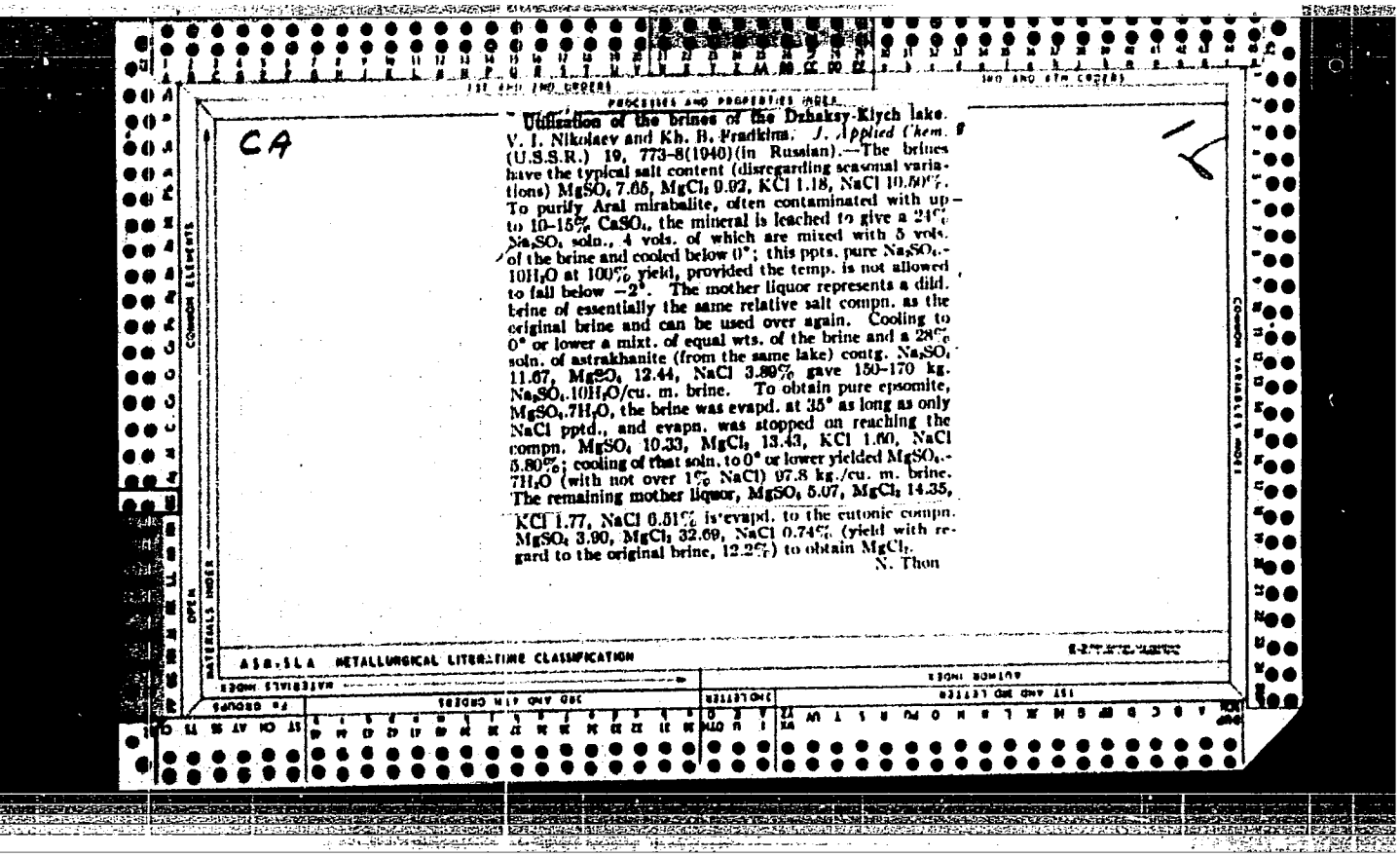


CA

8

The production of mirabilite from sulfate brines of the first and second types. V. I. Nekolaev and K. P. Pavlo[illegible] kina (Inst. General and Inorg. Chem., Moscow). *J. Applied Chem.* (U.S.S.R.) 19, 282-5(1946). Mirabilite yields from the cooling of type 2 (continental origin) sulfate brines from the Ebeity Sea were 1.5–2 times the yields from type 1 (marine origin) brines from the Kara-Bogaz Gulf. C. F.

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION



CA

Utilization of the brines of the Dzhaksy-Klych lake. V. I. Nikolaev and Kh. B. Pradkina. *J. Applied Chem.* (U.S.S.R.) 19, 773–8(1940)(in Russian).—The brines have the typical salt content (disregarding seasonal variations) $MgSO_4$ 7.65, $MgCl_2$ 9.92, KCl 1.18, NaCl 10.60%. To purify Aral mirabalite, often contaminated with up to 10–15% $CaSO_4$, the mineral is leached to give a 24% Na_2SO_4 soln., 4 vols. of which are mixed with 5 vols. of the brine and cooled below 0°; this ppts. pure $Na_2SO_4 \cdot 10H_2O$ at 100% yield, provided the temp. is not allowed to fall below −2°. The mother liquor represents a dild. brine of essentially the same relative salt compn. as the original brine and can be used over again. Cooling to 0° or lower a mixt. of equal wts. of the brine and a 28% soln. of astrakhanite (from the same lake) contg. Na_2SO_4 11.67, $MgSO_4$ 12.44, NaCl 3.89% gave 150–170 kg. $Na_2SO_4 \cdot 10H_2O$/cu. m. brine. To obtain pure epsomite, $MgSO_4 \cdot 7H_2O$, the brine was evapd. at 35° as long as only NaCl ppted., and evapn. was stopped on reaching the compn. $MgSO_4$ 10.33, $MgCl_2$ 13.43, KCl 1.60, NaCl 5.80%; cooling of that soln. to 0° or lower yielded $MgSO_4 \cdot 7H_2O$ (with not over 1% NaCl) 97.8 kg./cu. m. brine. The remaining mother liquor, $MgSO_4$ 5.07, $MgCl_2$ 14.35, KCl 1.77, NaCl 6.81% is evapd. to the eutonic compn. $MgSO_4$ 3.90, $MgCl_2$ 32.69, NaCl 0.74% (yield with regard to the original brine, 12.2%) to obtain $MgCl_2$.

N. Thon

FRADKINA, Kh. B.

(2)

Genesis and industrial application of the sulfate deposits of the Aral region. V. I. Nikolaev and Kh. B. Fradkina. *Izvest. Sektora Fiz.-Khim. Anal., Akad. Nauk S.S.S.R.* 17, 383–95(1949).—The Aral Sea occupies a special position because it is rich in K sulfate and Mg sulfate, and at the same time contains a reduced amt. of NaCl, in contrast to the other seas. By using water from the Aral Sea, the process of crystn. of its salts was studied by isothermal evapn. at 35°. The isothermal conditions were maintained over a period of 10 months in a specially constructed drying cabinet. The solid phase that sepd. was studied chemically and crystalloptically. On the phase diagram constructed, the crystn. of the following salts was observed: (1) gypsum, (2) NaCl, (3) NaCl and bloedite, (4) NaCl and epsomite, (5) NaCl and $MgSO_4.6H_2O$, and (6) NaCl and kainite and $MgSO_4.6H_2O$. It is possible that under conditions of the Aral region the formation of several forms of bloedite and method of recrystn. of epsomite and mirabilite proceed according to the following reaction: $MgSO_4.7H_2O + Na_2SO_4.10H_2O = Na_2SO_4.MgSO_4.4H_2O + 13H_2O$. N. and P., however, wishing to consider the origin of astrakhanite only as the result of recrystn. of epsomite and mirabilite, overlook the fact that at least 2 conditions are required for carrying out this reaction: (1) that temps. be above 6° and (2) presence of a liquid phase rich in Na_2SO_4, but not contg. Mg-Cl. As to industrial applications of the salts the following were mentioned: (1) Mg sulfate can be used for construction and for medical purposes, (2) epsomite with NaCl can serve as raw material for producing pure mirabilite and sulfate, and (3) methods for converting bloedite to mirabilite and epsomite have already been worked out. G. S. M.

10/27/54

Inst-Gen.+Inorg. Chem., AS USSR

/ Kinetics of transformation of carnallite and magnesium sulfate hexahydrate into kainite. V. I. Nikolaev and Kh. B. Pradkina. *Izvest. Sektora Fiz.-Khim. Anal., Akad. Nauk S.S.S.R.* 20, 200–70(1950).—The formation of kainite from metastable carnallite and $MgSO_4.6H_2O$ is assumed to proceed according to $KCl.MgCl_2.6H_2O + MgSO_4.6H_2O = KCl.MgSO_4.3H_2O + MgCl_2 + 9H_2O$. The isothermal (25°) formation of kainite was studied by placing the 2 solid phases in equiv. amts. under a brine the compn. of which corresponded to that part of the crystn. field of kainite where carnallite crystallizes under metastable conditions: $MgSO_4$ 5.63–6.00, $MgCl_2$ 21.20–22.23, KCl 3.18–3.47, NaCl 1.00–2.48, and KI 0.68–0.75%. The purpose of the KI was to enable the calcn. of the amt. of mother liquor adhering to the solid phase. For the rate of kainite formation under these conditions there was obtained a curve $y = x^{1.4}$, where y is time in hrs. and x is % of kainite formation. The rate of kainite formation dropped with time. By varying the $MgSO_4.6H_2O/KCl.MgCl_2.6H_2O$ ratio there was obtained a curve showing that the lowest rate of transformation coincided with a ratio of 1. At a ratio 2:1 the rate of transformation was approx. 2.5 times and at a ratio 1:2, 1.5 times as fast. The rate of transformation was also studied as affected by temp. 25–35°. The min. temp. needed as obtained by extrapolation was 23°. The polytherm can be expressed by $y = a^x$, where y is the rate of kainite formation, x the temp. interval in degrees from start of transformation (23°) and a is a const. For the interval 25–35° (x is 2–12) a was found to be 1.388–1.432 or an av. 1.410.

M. Hosch

FRADKINA, K.E.

Obtaining double salts under pressure. I. N. Lepeshkov, E. M. Savitskii, and Kh. E. Fradkina. *Izvest. Sektora Fiz.-Khim. Anal., Inst. Obshchei i Neorg. Khim., Akad. Nauk S.S.S.R.* 25, 144-9(1954).—The data suggest that under pressure deposits of single salts may form double salts. Double salts $Na_2SO_4.CaSO_4$, $KCl.MgSO_4.3H_2O$, $K_2SO_4.CaSO_4.H_2O$, and $K_2SO_4.MgSO_4.6H_2O$ were synthesized at high pressure and at 20 or 0°. Eurilla Mayerle

Inst. Gen. + Inorg. Chem. im Kurnakov, AS USSR

AUTHORS: Lepeshkov, I. N., Fradkina, Kh. B., SOV/2o-12o-1-21/63

TITLE: Carnallite and Syngonite in the Deposit of the Saltlake of Dzhaksy-Klych(Priaral'ye) (Karnallit i singenit v otlozhoniyakh solyanogo ozera Dzhaksy-Klych (Priaral'ye))

PERIODICAL: Doklady Akademii nauk SSSR, 1958, Vol. 12o, Nr 1, pp. 83 - 85 (USSR)

ABSTRACT: Calium-containing minerals occur very rarely in the deposits of recent salt lakes. The lake mentioned in the title containing the deposits mentioned is situated 2o km north-east of Aral'skoye. Besides concentrated salt solutions, also salt deposits in form of astrachanite (Na_2SO_4, $MgSO_4.4H_2O$), mirabilit($Na_2SO_4.10H_2O$), tenardit (Na_2SO_4) and magnesium sulphate, hepta-, hexa- and pentahydrate and further glauberite ($Na_2SO_4.CaSO_4$) and finally gypsite ($CaSO_4.2H_2O$) occur here. The total thickness of the layer reached 4,5 to 5m. Underneath a thick upper layer of salt the two first-mentioned minerals are to be found in the order mentioned. The magnesium sulphate hydrates occur in form

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Carnallite and Syngenite in the Deposit of the Salt- SOV/20-120-1-21/63
lake of Dzhaksy-Klych (Priaral'ye)

of crystals in the lower part of the astrachanite layer together with gypsite. Between the clusters of crystals thin crystalline inclusions of the latter mineral, syngenite, and Mg-pentahydrate (table 1) are to be found. Crystal-optical constants of synthetic and natural syngenite are mentioned. The heating curve of the sodium chlorite of the lake mentioned shows thermal effects which indicate a content of syngenite and astrachanite and also of the hydrates mentioned(figure 1). The forming of syngenite is probably a result of interaction between the lake salt solutions containing KCl up to 2% and gypsite. Syngenite is a rarety. Its synonymus is caluscite (Reference 2). The crystallization of carnallite was brought about by evaporation of salt solutions in summer. In addition, the magnesium sulphate hydrates and bischofites ($MgCl_2.6H_2O$) mentioned are formed. Table 2 describes the chemical and mineralogical analysis of the salt of the lake surface, figure 2 shows the heating curve of this salt, which consists of the three last-mentioned salts (including magnesium sulphate-hexahydrate). There are 2 figures, 2 tables and 2 references, which are Soviet.

Card 2/3

Carnallite and Syngenite in the Deposit of the Salt- SOV/20-120-1-21/63
lake of Dzhakay-Klych (Priaral'ye)

ASSOCIATION: Institut obshchey i neorganicheskoy khimii im. N. S. Kurnakova Akademii nauk SSSR (Institute of General and Inorganic Chemistry imeni N. S. Kurnakov, AS USSR)

PRESENTED: November 1, 1957, by I. I. Chernyayev, Member, Academy of Sciences, USSR

SUBMITTED: October 31, 1957

1. Inland waterways--Sedimentation 2. Minerals--Sources
3. Minerals--Chemical analysis

Card 3/3

S/078/61/006/001/010/019
B017/B054

AUTHORS: Lepeshkov, I. N., Fradkina, Kh. B.

TITLE: Study of Solubility at 50°C in the System Li, Na || SO_4, CO_3 - H_2O

PERIODICAL: Zhurnal neorganicheskoy khimii, 1961, Vol. 6, No. 1, pp. 199 - 207.

TEXT: The authors studied the solubility in the quaternary system Li, Na || SO_4, CO_3 - H_2O at 50°C, and determined the crystallization ranges. Results are shown as Jänecke diagrams in Figs.2 and 3. Fig.1 shows the distribution of crystallization ranges. The following ranges were found: Li_2CO_3, $Na_2CO_3.H_2O$, $Na_2CO_3.2Na_2SO_4$, Na_2SO_4, $Na_2SO_4.Li_2SO_4$, and $Li_2SO_4.H_2O$. The crystallization range of Li_2CO_3 comprises the major part of the diagram. Table 3 gives the ratio of components of simultaneous crystallization Li_2CO_3 + $Na_2CO_3.2Na_2SO_4$. Fig.4 shows microphotographs of crystals from Li_2CO_3 + $Na_2CO_3.H_2O$ (a), Li_2CO_3 + Na_2SO_4 (b),

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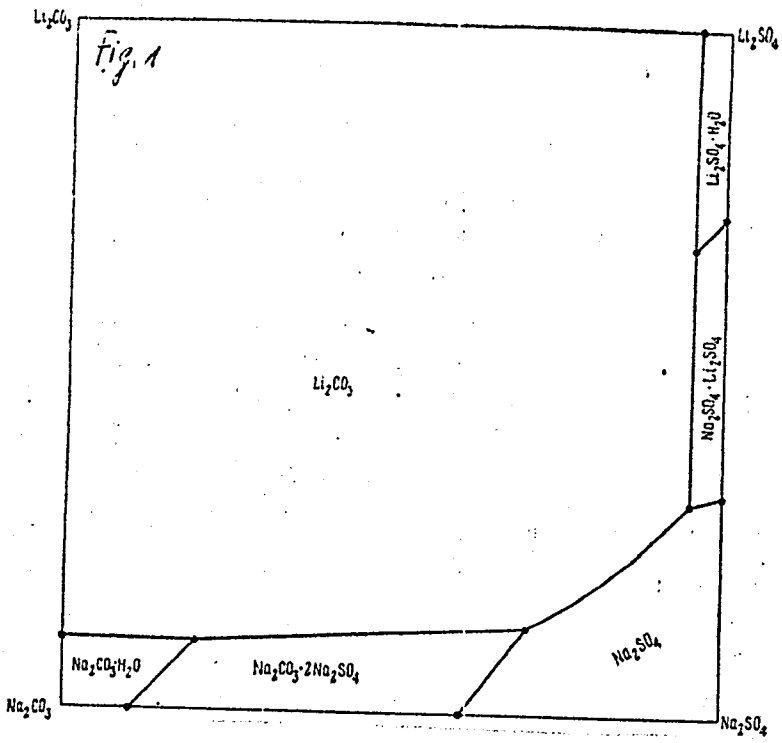
$Na_2SO_4.Li_2SO_4$ (v), and $Li_2SO_4.H_2O$ (g). Fig.5 shows thermograms of Li_2CO_3 (a), $Li_2SO_4.H_2O$ (b), Na_2SO_4 + $Li_2SO_4.Na_2SO_4$ (v), and Li_2CO_3 and $Na_2CO_3.2Na_2SO_4$ (g). Fig.6 shows the distribution curves of components between liquid and solid phases in simultaneous crystallization of Li_2CO_3 and $Na_2CO_3.2Na_2SO_4$. Hence it appears that limited solid solutions are formed in simultaneous crystallization of Li_2CO_3 and $Na_2CO_3.2Na_2SO_4$. The crystallographic investigations were made by M. N. Lyashenko. G. G.Urazov, Z. I. Lifatova, P. S. Kindyakov, L. S. Itkina, and N. M. Chaplygina are mentioned. There are 6 figures, 3 tables, and 21 references: 12 Soviet, 3 US, 1 British, 1 Canadian, 1 French, 1 German, and 1 Italian.

SUBMITTED: June 2, 1960

Fig. 1



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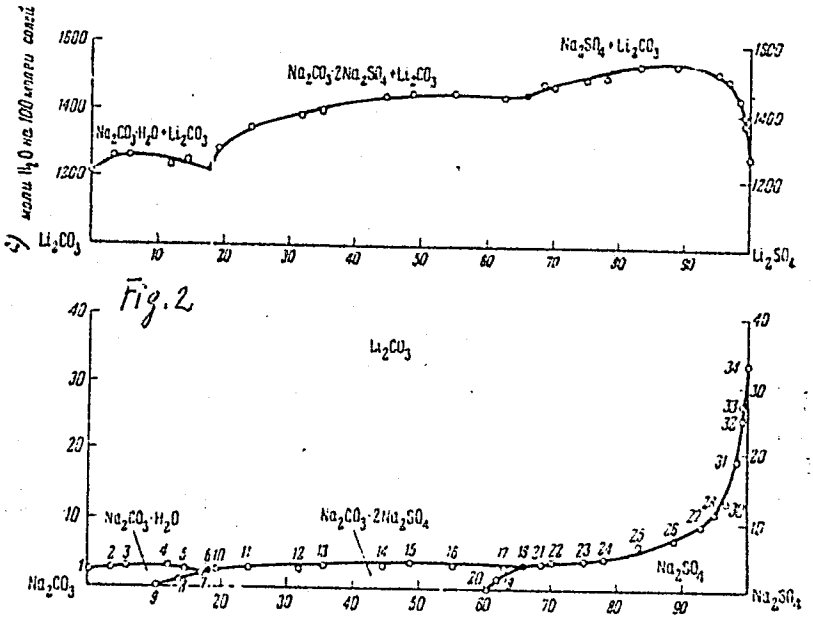

Fig. 2

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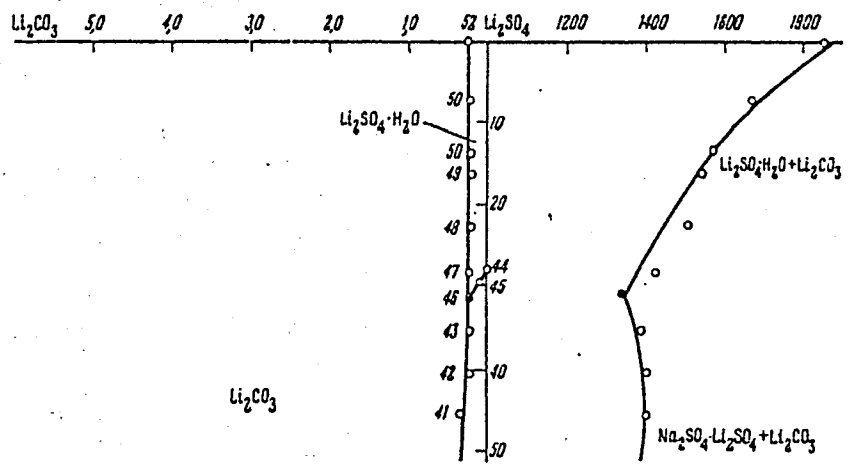

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B017/B054

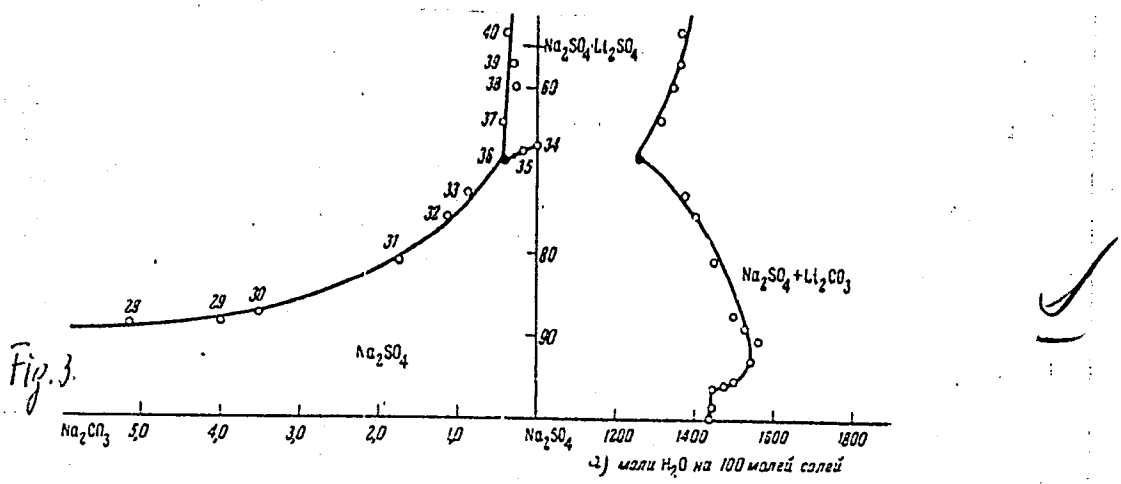

Fig. 3.

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Legend to Fig.1: Crystallization fields in the system Li, Na||SO_4,CO_3 - H_2O at 50°C.

Legend to Fig.2: Solubility in the system Li, Na||SO_4, CO_3 - H_2O at 50°C in the range of crystallization of $Na_2CO_3 \cdot H_2O$, $Na_2CO_3 \cdot 2Na_2SO_4$, Na_2SO_4, and Li_2CO_3; a) moles of H_2O per 100 moles of salts.

Legend to Fig.3: Solubility in the system Li, Na||SO_4, CO_3 - H_2O at 50°C in the range of crystallization of Na_2SO_4, $Na_2SO_4 \cdot Li_2SO_4$, $Li_2SO_4 \cdot H_2O$, and Li_2CO_3; a) moles of H_2O per 100 moles of salts

Card 7/7

SEDEL'NIKOV, G.S.; TROFIMKVICH, A.A.; FRADKINA, Kh.B.

Production of potassium sulfate from Kara-Bogaz-Gol brines. Zhur. prikl.khim. 34 no.7:1437-1444 Jl '61. (MIRA 14:7)

1. Institut obshchey i neorganicheskoy khimii imeni N.S.Kurnakova AN SSSR.

(Kara-Bogaz-Gol—Potassium sulfate)

LEPESHKOV, I.N.; FRADKINA, Kh.B.

Study of salt equilibria in the system Li, Na // SO_4, CO_3 - H_2O at 100°C. Zhur.neorg.khim. 8 no.2:447-456 F '63. (MIRA 16:5)

1. Institut obshchey i neorganicheskoy khimii imeni N.S.Kurnakova AN SSSR.

(Salts) (Phase rule and equilibrium)

BELOSTOTSKIY, Ye.M.; VILENKINA, A.Ya.; FRADKINA, M.Ya., professor, redaktor; AMASHUKELI, M.Ye., redaktor

[The fundus of the eye in hypertonia] Glaznoe dno pri gipertonicheskoi bolezni. Moskva, Trest "Meduchposobie," 1956. 175 p. (MLRA 9:12)
(HYPERTENSION) (EYE)

9(3)

SOV/79-29-8-34/81

AUTHORS: Nazarov, I. N., Prostakov, N. S., Mikheyeva, N. N., Fradkina, N. A.

TITLE: Synthesis of γ-Halogen-substituted 1,2,5-Trimethyl-, 2,5-Dimethyl-, and 1-Acyl-2,5-dimethyl Piperidines

PERIODICAL: Zhurnal obshchey khimii, 1959, Vol 29, Nr 8, pp 2609-2613 (USSR)

ABSTRACT: There are but little data available in publications dealing with the γ-halogen-substituted piperidines. On the basis of the method of synthesizing the secondary and tertiary γ-piperidoles already devised by the authors (Ref 2), they investigated the substitution of halogen for the oxy-group of these piperidine alcohols. The piperidoles (III) and (IV) used as initial products were converted by reduction of the piperidones (I) and (II). The compounds (Va) and (VI) were formed on reaction of the corresponding piperidoles with thionyl chloride (70% yield). In this way, the mixture of the stereoisomeric 1,2,5-trimethyl-4-chloro-piperidines (Va) is formed from the mixture of the stereoisomeric 1,2,5-trimethyl-4-piperidoles (III) which is obtained by reduction of piperidone (I) with sodium in alcohol. In this first-mentioned mixture, one of the isomers is predominant (70%), which melts in the form of the picrate at 198-200°. The same isomer of the chloride (Va) was also obtained from 1,2,5-trimethyl-4-pi-

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peridole (melting-point 72-73°), which was separated from the mixture of the stereoisomeric piperidoles (III) (also in a yield of 7o%). In the same way, compound (VI) was formed which was converted into (XVI) with acetic anhydride. Compound (Vb) resulted on reaction of the piperidole (III) with phosphorus tribromide. The halogen-substituted derivatives (Va) and (Vb) can only be distilled in the vacuum. On standing, and at 13o°, they are transformed into hygroscopic products. Further chemical transformations of 1,2,5-trimethyl-4 and 2,5-dimethyl-4-chloro-piperidine were carried out. There are 4 references, 3 of which are Soviet.

ASSOCIATION: Moskovskiy institut tonkoy khimicheskoy tekhnologii (Moscow Institute of Fine Chemical Technology)

SUBMITTED: July 1o, 1958

FRADKINA, R. V., BERMAN, V. M., Ye. M. SLAVSKAYA

"The Influence of the Durand-Reynals Factor on the Spread of Bacteria in the Organism and the Depth of Active Immunity on Vaccination," in the book: Voprosy vozrastnoy immunologii, 1, 158-171, Leningrad, 1947

FRADKINA, S.L

FRADKINA, S.L.

Pulseless disease. Sov.med. 21 no.5:49-52 My '57. (MLRA 10:7)

1. Iz kafedry gospital'noy terapii (zav. - prof. P.Ye.Lukomskiy) II Moskovskogo meditsinskogo instituta imeni I.V.Stalina i 4-y gorodskoy klinicheskoy bol'nitsy (glavnyy vrach - zasluzhennyy vrach RSFSR M.V.Ivanyukov).
(AORTA, dis.
aortic arch synd.)

KRYUKOVA, L.M.; PRADKINA, S.F.; [illegible]; [illegible]; PAVORSKIY, O.V.

Esters of aliphatic amino alcohols. Zhur. prikl. khim. 38 no.1: 159-166 Ja '65. (MIRA 18:3)

FRADKINA, T. P.

(J)

4.

Kinetics of reactions between solid substances. A. M. Ginstling and T. P. Fradkina. *Zhur. Priklad. Khim.* 25, 1134–42(1952).—The classification of solid-state reactions as chem. (I), diffusional (II), and gaseous (sublimation or evapn.) (III) was previously made and the corresponding math. equations were given (Pozin and Ginstling, *C.A.* 47, 30g). To confirm these theoretical equations expts. were carried out with mixts. of $CaCO_3$ and MoO_3. Initially, MoO_3 sublimes and forms a film of $CaMoO_4$, and as this thickens, the rates of diffusion of MoO_3 toward the center and CO_2 outward become the controlling factors, and equation II should be applicable. Mixts. of $CaCO_3/MoO_3 = 1$, $r_{MoO_3} = 0.036$ and $r_{CaCO_3} = 0.13$ and 0.153 mm., were heated at 580 and 600°. Plots of K_2 vs. r (K_2 is rate const. in equation II, τ time in min., and r is the radius of the granules) are straight lines, and K_2 is const. for $G > 0.5$. Jander's equation (*C.A.* 21, 3798) did not yield const. values for K_2. To reduce the diffusional effect and make the evapn. rate-controlling the following mixt. was prepd.: $CaCO_3/MoO_3 = 15$, $r_{CaCO_3} < 0.030$, $r_{MoO_3} = 0.052$, 0.064, 0.110, 0.130, and 0.153 mm. Data at 620° were accurately expressed by equation III. K_3 vs. τ gave a family of straight lines from the origin. Mixts. with $MoO_3/CaCO_3 = 3$, r of $CaCO_3$ and MoO_3 0.13 and 0.064 mm., heated at 580° were at first controlled by rates of evapn., and K_3 was const. up to $\tau = 38.5$ min. and $G = 0.1486$); then the rate of diffusion became controlling and K_2 was const. up to $\tau = 102$ min. and $G = 0.8730$ (G = degree of conversion of $CaCO_3$ to $CaMoO_4$). Cf. preceding abstr.

I. B.

FRADKINA T.P.

"Kinetics of reactions between solid substances," I. A. M. Ginstling and T. P. Fradkina, Zh. Prikl. Khim. U.S.S.R. 23, 1190-1201 (Translation).—See C.A. 48, 07011. H. L. H.

FRADKINA, T. P.

The kinetics of reactions in mixtures of solid substances. II. A. M. Ginstling and T. P. Fradkina. *J. Appl. Chem. U.S.S.R.* 25, 1325-32 (1952)(Engl. translation); *Zhur. Prikład. Khim.* 25, 1298-70(1953); cf. *C.A.* 47, 39g; 48, 977f, 976f.—The reaction $Na_2CO_3 + SiO_2 \rightarrow Na_2SiO_3 + CO_2$ was investigated by the observation of the wt. loss of the reaction mixt. and by the measurement of the amt. of unreacted SiO_2. At 800°, with pure reagents of 0.072 mm. av. particle diam., the process was controlled by the diffusion of Na_2CO_3 through the silicate and the diffusion rate equation of Ginstling and Braunshtein (*C.A.* 46, 9959c) was obeyed. Metasilicate (Na_2SiO_3) was obtained when the ratio SiO_2/Na_2CO_3 was smaller than 2. The orthosilicate (Na_4SiO_4) was formed above this value. The mechanism changed on addn. of NaCl (3% of wt. of Na_2CO_3) to an equimolar mixt. of reactants at 750°. The chemically inert NaCl formed a eutectic mixt. with Na_2CO_3, which in contact with SiO_2 resulted in silicate formation. As more Na_2CO_3 was taken up in the eutectic, the reaction proceeded at const. concn. of reacting substances, following the equation $dG/dt = K_1(1 - G)^{2/3}$. A 2nd step began when all of the Na_2CO_3 had gone into the eutectic and the 1st order rate of reaction was detd. by the changes in Na_2CO_3: $dG/dt = K_2(1 - G)^{2/3}$. In the 3rd step the quantity of the liquid phase decreased, but its concn. in Na_2CO_3 remained const. The rate equation of the 1st step was followed, although less rigorously. Other exptl. conditions can be chosen to observe an initial const. rate $dG/dt = K_3$, when $G << t$, or a final transition into a diffusion-controlled stage. G is the degree of transformation of substances; t is the time; K_1, K_2, and K_3 are consts.

J. L. Weininger

T. P. FRADKINA, T. P.

A method of salt synthesis without evaporation. M. I. Tsal and T. P. Fradkina. *Khim. Prom.* 1956, 363.—Readily hydrolyzable or in general unstable salts ($(NH_4)_2CO_3$, $Ba(HCO_3)_2$, ammonium succinate, etc.) are prepd. by using the raw materials either as satd. solns. or as thick suspensions. The mixt. is heated to a temp. below that at which it begins to decomp., producing a satd. or even supersatd. soln., from which the required products crystallize on cooling, are cooled, filtered, and dried under optimum conditions.
W. M. Sternberg

VAKULOVA, L.A.; FOKINA, L.N.; FRADKINA, T.S.; LUK'YANOVA, L.V.; SAMOKHVALOV, G.I.

Pyrophosphoric ester of 3-methyl-2-buten-1-ol.
Dokl. AN SSSR 147 no.1:103-105 N '62. (MIRA 15:11)

1. Vsesoyuznyy nauchno-issledovatel'skiy vitaminnyy institut. Predstavleno akademikom M.I. Kabachnikom.
(Pyrophosphoric acid)
(Butenol)

MIROPOL'SKAYA, M.A.; MEL'NIK, S.Ya.; FRADKINA, T.S.; SAMOKHALOV, G.I.; PETROV, A.D.

Selective reduction of 6-methyl-3,5-heptadien-2-one by trialkoxy- and trialkylsilane hydrides. Dokl. AN SSSR. 144 no.6:1312-1313 Je '62. (MIRA 15:6)

1. Vsesoyuznyy nauchno-issledovatel'skiy vitaminnyy institut i Institut organicheskoy khimii im. N.D.Zelinskogo Akademii nauk SSSR.
2. Chlen-korrespondent Akademii nauk SSSR (for Petrov).
(Heptadienone) (Silane)

GOL'DBERG, K.M.; GEL'FANDBEYN, N.M.; Prinimali uchastiye: BARIL'OTI, A.S.; KAPUSTINA, A.I.; LINKOVA, L.M.; STRUKOVA, V.A.; SERKOVA, L.V.; FRADKINA, TS.Ye.

Anticorrosive alkyd GF-020 priming. Lakokras.mat.i ikh prim. no.2:71-74 '62. (MIRA 15:5)

1. Khar'kovskiy lakokrasochnyy zavod "Krasnyy khimik".
(Protective coatings)

FRADKINA, V. Ye. PA 31/49T8

USSR/Medicine - Penicillin, Therapy Aug 48
Medicine - Leukemia, Experimental

"A Case of Acute Myeloblastic Leukosis Cured by the Administration of Penicillin," V. Ye. Fradkina, S. V. Zlotnikova, Therapeutics Clinic, Cen Inst for Advancement of Doctors, and Lab, Clinical Ord of Lenin Hosp imeni Botkin, 6¼ pp

"Klin Med" Vol XXVI, No 8

Previously, patients with acute leukosis were hopeless. Presents detailed account of treatment given to patient which resulted in considerable improvement. Patient is still under observation.

[redacted] 31/49T8

USSR/Medicine Dec 48
Vitamins
Blood Circulation

"Vitamin B_1 During Insufficiency in the Circulation of the Blood," V. Ye. Fradkina, First Therapeutic Clinic, Cen Inst for Advancement of Doctors, 9 pp

"Klin Med" Vol XXVI, No 12

Gives results of isolating B_1 from the urine during various disturbances of the circulation. When there are no changes in the cardiovascular system, amount of Vitamin B_1 extracted appears to be greater than in cases of heart trouble. After use for deficiency

60/49761

USSR/Medicine (Contd) Dec 48

in blood circulation, combined with preparations of the digitalis group, the amount of B_1 isolated from the urine is increased.

60/49761

FRADKINA, V. Ye.

FRADKIN, V Ye

Protein content of blood in gastric and duodenal ulcers. V. E. Fradkina and R. I. Batrin. *Klin., Med.* (U.S.S.R.) 31, No. 10, 80-6(1953).—Total protein is between 6 and 8.2% in cases of gastric and duodenal ulcers. Less than 7% is found in cases with complications. The A/G ratio is normal unless complications arise. The fibrinogen is increased in most cases. The detn. of total protein and its components may be found useful in detg. the urgency of surgical intervention or deciding upon the appropriate course of treatment.
A. Mirkin

Iz 1-y terapevticheskoy kafedry (direktor - deystvitel'nyy chlen Akademii meditsinskikh nauk SSSR professor M. S. Votchal) TSentral'nogo instituta usovershenstvovaniya vrachey.

FRADKINA, V.Ye., kandidat meditsinskikh nauk

Prothrombin and fibringen levels in myocardial infarct and strenocardia. Terap.arkh. 28 no.6:32-39 '56. (MLRA 9:11)

1. Iz 1-y terapevticheskoy kafedry (zav. - deystvitel'nyy chlen AMN SSSR prof. M.S.Vovsi) TSentral'nogo instituta usovershenstvovaniya vrachey na baze bol'nitsy imeni S.P.Botkina.

(PROTHROMBIN, determination,
in angina pectoris & myocardial infarct (Rus))
(FIBRINOGEN, determination,
same)
(ANGINA PECTORIS, blood in,
fibrinogen & prothrombin levels (Rus))
(MYOCARDIAL INFARCT, blood in,
same)

FRADKINA, V.Ye.

Clinical picture of Schoenlein-Genochis disease. Probl.gemat. i perel. krovi 2 no.2:56-58 Mr-Ap '57. (MIRA 10:6)

1. Iz 1-y terapevticheskoy kafedry TSentral'nogo instituta usovershenstvovaniya vrachey (dir. - deystvitel'nyy chlen Akademii meditsinskikh nauk SSSR prof. M.S.Vovsi) na baze klinicheskoy ordena Lenina bol'nitsy imeni S.P.Botkina (glavnyy vrach - prof. A.N. Shabanov).

(PURPURA, NONTHROMBOPENIC, case reports
Schoenlein's purpura (Rus))

FRADKINA, V.Ye.

Diagnosis of microfocal lesions of the myocardium. Terap. arkh. 32 no. 4:13-18 S '60. (MIRA 14:1)

(ANGINA PECTORIS)

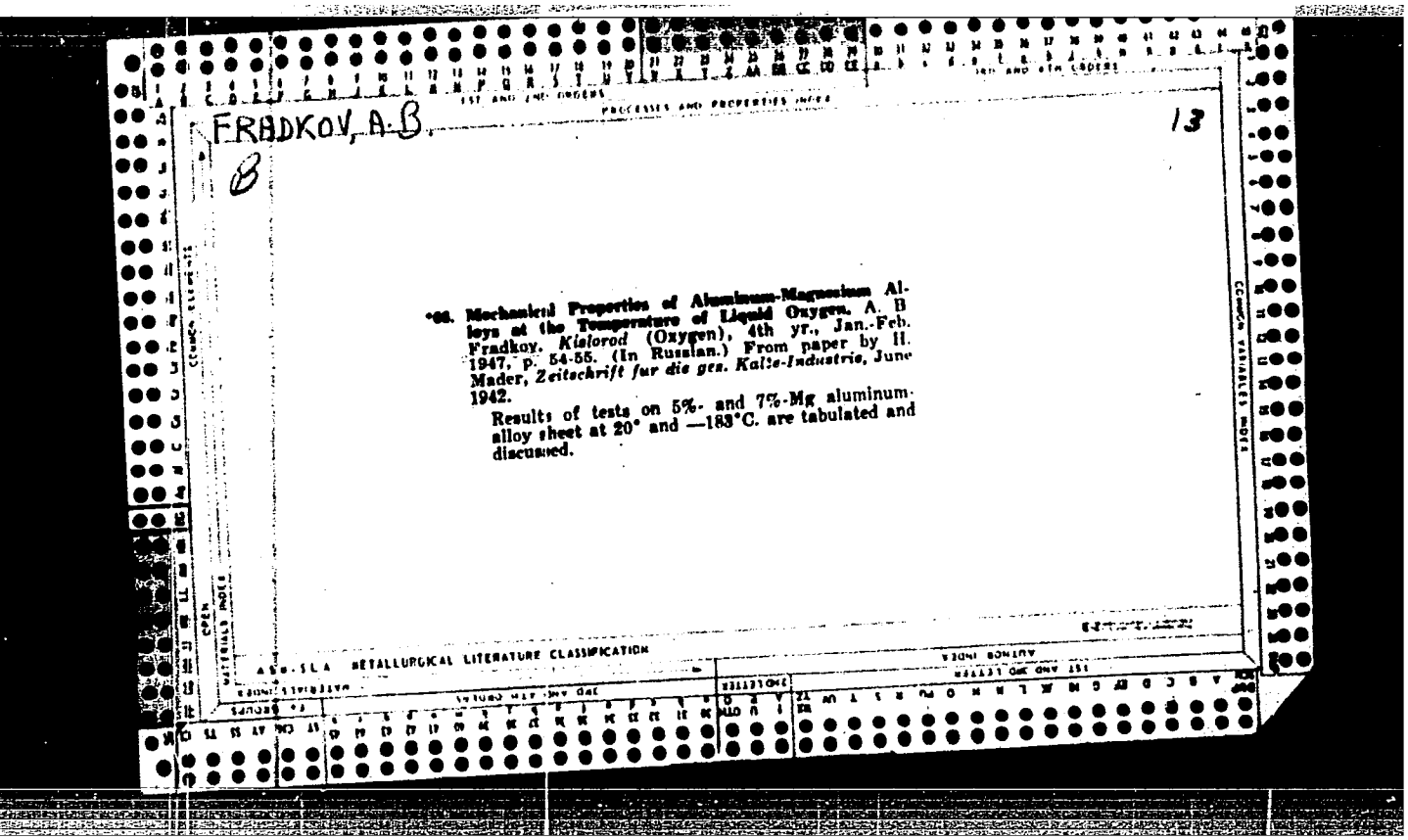
KHOMYAKOV, Yu.S., kand. med. nauk; FRADKINA, Ye.B.

Possibility of X-ray examination and detection of air in the pleural cavity in the presence of fluid in it; study on a phantom. Vest. rent. i rad. 40 no.1:60-61 Ja-F '65.
(MIRA 18:6)

1. Kafedra rentgenologii i radiologii (zav.- prof. V.A. D'yachenko) II Moskovskogo meditsinskogo instituta imeni Pirogova.

INGLEZI, Raisa Markovna; FEADKINA, Zinaida L'vovna; STEPANOVA, L.I., redaktor; TALANTOVA, M.N., redaktor; KHOVANSKIY, I.P., tekhnicheskiy redaktor

[Through Soviet eyes; travel notes on foreign countries, recomended reading list] Glazami sovetskikhliudei; putevye zapiski o zarubezhnykh stranakh. rekomendatel'nyi ukazatel' literatury. Moskva, Gos. biblioteka SSSR im. V.I.Lenina, 1956. 53 p. (MLRA 9:11)
(Bibliography--Voyages and travels)



FRADKOV, A.B.

13

*68. Mechanical Properties of Aluminum-Magnesium Alloys at the Temperature of Liquid Oxygen. A. B Fradkov. *Kislorod* (Oxygen), 4th yr., Jan.-Feb. 1947, p. 54-55. (In Russian.) From paper by H. Mader, *Zeitschrift fur die ges. Kalte-Industrie*, June 1942.

Results of tests on 5%- and 7%-Mg aluminum-alloy sheet at 20° and —183°C. are tabulated and discussed.

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

FRADKOV, A. B.

PA 11T54

USSR/Gas Flow - Measurements May 1947
Films, Liquid

"The Disruption of a Liquid Air Film by a Gas Flow," A. B. Fradkov, 8 pp

"Zhur Eksp i Teor Fiz" Vol XVII, No 5

A determination of the "critical" speed of gas, at which gas begins to disrupt the film of liquid air flowing in the tube and the so-called "choking" phenomenon takes place in the tube.

11T54

FRADKOV, A. B.

USSR/Physics - Low Temperatures Dec 51

"Near Absolute Zero," M. P. Malkov, A. B. Fradkov

"Nauka i Zhizn'" Vol XVIII, No 12, pp 21-24

Reviews low temp phys, describes method of liquefaction of hydrogen, and explains phenomena of superfluidity of helium. The scientific world is indebted to Soviet scientists P. L. Kapitsa, L. D. Landau, A. I. Shalnikov, B. G. Lazarev, N. Ye. Alekseyevskiy, V. P. Peshkov, and others.

209T102

FRADKOV, A. B.

USSR/Physics - Insulation, Heat 1 Dec 51

"Problem Concerning New Methods for Heat Insulating Deep-Cold Apparatus," A. B. Fradkov, Inst of Phys Problems imeni Vavilov, Acad Sci USSR

"Dok Ak Nauk SSSR" Vol LXXXI, No 4, pp 549-551

Investigates the vaporization of liquid air for various conditions governing the insulation of containers: high vacuum (10^{-5} mm/Hg), prevacuum (3.10^{-3} mm/Hg), residual hydrogen gas, microporous rubber under atm pressure, mipor under 10^{-2} mm/Hg. Studies the evapn (liters/min) of liquid hydrogen vs time (hrs) for various conditions. Submitted by Acad A. F. Ioffe 6 Oct 51.

202T92

FRADKOV, A. B.

PA 244T102

USSR/Physics - Low Temperatures; Heat Exchangers Mar 52

"A Hydrogen Liquefaction Station for Scientific-Research Institutes," M. P. Malkov and A. B. Fradkov, Inst of Phys Prob imeni S. I. Vavilov

"Zhur Tekh Fiz" Vol 22, No 3, pp 436-446

Describes hydrogen liquefaction station (IFP VOS-2) consisting essentially of gas-holder, compressor, purifier, and liquefier designed at the authors' institute. Work of P. L. Kapitza was used extensively in developing station, which requires only Soviet machines, instruments, and materials. Data on experimental model designed at institute is as follows: productivity, 8.6 liters of liquid H_2 per hr; expenditure of liquid nitrogen, 1.3 liter per liter H_2; specific power consumption, 4.4 kwhr per liter H_2. Submitted 10 Sep 51.

244T102

FRADKOV, A.B.

4E4b

2
4E4b

Apparatus for investigating metals at the temperature of liquid hydrogen. A. B. Fradkov. *Pribory i Tekh. Eksperim.* 1956, No. 2, 111-2.—An app. is described for the investigation of samples of metals, 1-3 mm. in diam. and up to 8 m. long (i.e. wires), at 20°K. W. Jacobson

KHL
MT

AUTHORS: Brilliantov, N. A., and Fradkov, A. B. 57-10-29/33

TITLE: The Degree of Purification of Hydrogen and Helium by Chromatographic Process on Activated Charcoal (Stepen' ochistki vodoroda i geliya khromatograficheskim protsessom na aktivirovannom ugle).

PERIODICAL: Zhurnal Tekhn. Fiz., 1957, Vol. 27, Nr 10, pp. 2404-2409 (USSR).

ABSTRACT: According to the isotherm for the adsorption of N_2 and O_2 the degree of the purification of hydrogen and helium of nitrogen and oxygen is classified according to the method of chromatographic separation with activated charcoal. The authors show that by means of the adsorption with activated charcoal at T = 80°K the technical hydrogen of (N_2+O_2) -admixtures can be purified to a concentration below 2.10^{-10}-part, this, however, under the condition of a charcoal regeneration by means of pumping-off. The magnitude of the 2.10^{-10} - part is the limit of sensitivity of the analyser used for the experiments. In the case of a charcoal regeneration by means of blowing the purified gas contains admixtures of below 5.10^{-9} - parts.

Card 1/2 There are 1 table, 3 illustrations and 4 Slavic references.

The Degree of Purification of Hydrogen and Helium by Chromatographic Process on Activated Charcoal. 57-10-29/33

ASSOCIATION: Institute for Physical Problems AN USSR, Moscow (Institut fiziches-kikh problem AN SSSR, Moskva).

SUBMITTED: March 4, 1957.

AVAILABLE: Library of Congress.

Card 2/2

SOV/120-58-4-29/30

AUTHOR: Fradkov, A. B.

TITLE: Containers for Storage and Transport of Liquid Helium (Sosudy dlya khraneniya i perevozki zhidkogo geliya)

PERIODICAL: Pribory i tekhnika eksperimenta, 1958, Nr 4, pp 108-109 (USSR)

ABSTRACT: A modified form of a Dewar container with a useful capacity of 10 litres is described. It may be used to store liquid helium and liquid hydrogen over long periods of time. The helium loss is 0.2 litres of liquid helium per day, when the container has a single screen cooled by liquid hydrogen. With an additional intermediate screen this loss is less than 0.1 litre per day. A typical container is shown in Fig 1. The container is spherical in form so that standard copper hemispheres may be used. The inner sphere, 1, is filled with helium and has a capacity of 10 litres. It is suspended from a thin-walled tube (5) made from stainless steel in a nitrogen bath (2). This tube is attached to the nitrogen bath at the point (a) which is at a temperature of 80°K. Its upper end passes freely through the cover (7) and a bellows (6). The nitrogen bath (2) has a capacity of 4.6 litres and is in its turn suspended from a thin-walled tube of stainless steel (4). The

Card 1/2

Containers for Storage and Transport of Liquid Helium

tube is attached to the main body at the point B. Spaces between the inner sphere and the nitrogen bath and between the nitrogen bath and the outer container, are evacuated to a very low pressure through the connecting pipe (9). The high vacuum is maintained by activated charcoal. Total weight of the container is 15 kg. Containers of this type have been used at the Institute for Physical Problems since January, 1957. Yu. Yu. Lur'ye and S. A. Yakovlev are thanked for their help during this work. There is 1 figure and 1 English reference.

ASSOCIATION: Institut fizicheskikh problem AN SSSR (Institute for Physical Problems, Academy of Sciences, USSR)

SUBMITTED: March 17, 1958.

Card 2/2

AUTHOR: Fradkov, A. B., Candidate of Technical Sciences SOV/67-11-5-3/18

TITLE: Hydrogen Liquefier VOS-3 (Vodorodo-ozhizhitel'naya stantsiya VOS-3)

PERIODICAL: Kislorod, 1958, Vol 11, Nr 5, pp 21-28 (USSR)

ABSTRACT: This article gives a description of the construction and of the mechanism of an installation for hydrogen liquefaction VOS-3. It consists of a purification block (Fig. 6) which purifies technical GOST 3022-45 hydrogen of water vapor on silicagel and adsorbs $N_2 + O_2$ on activated charcoal.

It purifies the hydrogen up to 10^{-9} portions of air in the volume; the gasholder - floating bell and the receiver for the accumulation of gaseous hydrogen for the compression; the compressor IVUV-45/150 which is able to compress the hydrogen to 130-150 atmospheres; the block for the separation of the oil penetrating into the hydrogen from the lubricant of the compressor (2 parts: separation of oil drops and adsorption by activated charcoal) and the liquefier. The latter consists of two "heat exchangers" (1), spiral pipes

Card 1/3

for the supply of the compressed hydrogen and for the removal of the expanded hydrogen and of the gaseous nitrogen; of the tank with liquid nitrogen, for low-cooling; the heat exchanger (2) of the cold zone with the pipes for the supply and removal of compressed and re-expanded hydrogen respectively; of the throttle valve and the container for the collection of the liquid hydrogen. The whole is insulated by a vacuum casing, filled with "Mipor". For liquefaction hydrogen obtained by hydrolysis is used. Firstly, it is purified, accumulated, compressed and conveyed to the liquefier. In the heat exchanger (1) it is precooled, low-cooled by the liquid nitrogen and the heat exchanger (2) up to a temperature of 36-40° K. Behind the throttle valve of liquid hydrogen occurs. Behind the throttle valve there is a hydrogen pressure of 0.3-0.8 atmospheres. The non-liquefied hydrogen is conveyed back through the heat exchanger and the nitrogen tank to the compressor. For the prevention of explosions (exhaust of hydrogen gas) a special packing is installed on the compressor at the outlet of the crankshaft. Also crystalline oxygen occurring in liquid hydrogen can be the cause of explosions

in the case of sparks, for instance from electric installations. Therefore a high degree of purity of the used hydrogen is necessary. As a particular feature it is noted that the purification block can work independent of the other parts of the liquefier. The VOS-3 liquifies 8-10 l hydrogen per hour. The liquefier is developed according to the directives given by Kapitsa (Ref 1). There are 6 figures and 9 references, 6 of which are Soviet.

FRADKOV, A.B.

(4) PHASE I BOOK EXPLOITATION SOV/2713

International Conference on the Peaceful Uses of Atomic Energy. 2nd, Geneva, 1958

Doklady sovetskikh uchenykh; polucheniye i primeneniye izotopov (Reports of Soviet Scientists; Production and Application of Isotopes) Moscow, Atomizdat, 1959. 388 p. (Series: Its: Trudy, vol. 6) 8,000 copies printed.

Eds. (Title page): G.V. Kurdyumov, Academician, and I.I. Novikov, Corresponding Member, USSR Academy of Sciences; Ed. (Inside book): Z.D. Andreyenko; Tech. Ed.: Z.D. Andreyenko.

PURPOSE: This book is intended for scientists, engineers, physicians, and biologists engaged in the production and application of atomic energy to peaceful uses; for professors and graduate and nongraduate students of higher technical schools where nuclear science is taught; and for the general public interested in atomic science and technology.

COVERAGE: This is volume 6 of a 6-volume set of reports delivered by Soviet scientists at the Second International Conference on the Peaceful Uses of Atomic Energy held in Geneva from September 1 to 13, 1958. Volume 6 contains 32 reports on: 1) modern methods for the production of stable radioactive isotopes and their labeled compounds, 2) research results obtained with the aid of isotopes in the field of chemistry, metallurgy, machine building, and agriculture, and 3) [illegible] of ionizing radiation. Volume 6 was edited by: S.V. Levinskiy, Candidate of Medical Sciences; V.N. Prusakov, Candidate of Chemical Sciences; and V.V. Sedov, Candidate of Medical Sciences. See SOV/2081 for titles of volumes of the set. References appear at the end of the articles.

3. Yakovlev, G.N., and V.B. Dedov. Means of Developing Remote Control Methods in the Radiochemical Laboratories of the AN SSSR (Report No. 2025)

4. Malkov, M.P., A.G. Zel'dovich, A.B. Fradkov, and I.B. Danilov. Commercial Production of Deuterium by the Low-temperature Distillation Method (Report No. 2323) 41

5. Gverdtsiteli, I.G., R.Ya. Kucherov, and V.K. Tskhakaya. Separation of Isotopes by Diffusion in a Steam Flow (Report No. 2036) 54

6. Zolotarev, V.S., A.I. Il'in, and Ye.G. Komar. Separation of Isotopes on Electromagnetic Units in the Soviet Union (Report No. 2305) 69

7. Alekseyev, B.A., S.P. Balygin, V.S. Zolotarev, B.V. Panin, Ye.S. Chernorotov, and G.Ya. Shchepkin. Separation of Isotopes of Rare-earth Elements by the Electromagnetic Method (Report No. 2217) 87

8. Morozov, P.M., B.N. Makov, M.S. Ioffe, B.G. Brezhnev, and G.M. Frafkin. Ion Source for the Separation of Stable Isotopes (Report No. 2303) 102

9. Beslin, M.V., and P.M. Morozov. Electric Field Effect in Ion Beams on Stable Isotope Separation by the Electromagnetic Method (Report No. 2304) 111

10. Bogdanova, N.G., P.L. Gruzin, G.I. Yermolayev, and I.D. Kikulinskiy. Use of Radioactive Isotopes in Metallurgical Research (Report No. 2218) 117

11. Shumilovskiy, N.N., V.A. Yanushkovskiy, and I.M. Taksar. The Theory and Practice of Relay-type Instruments Based on Radioactive Isotopes (Report No. 2232) 124

12. Zaslayevskiy, Yu.S., G.I. Shor, and R.N. Shneyerova. Studying the Mechanism of Protection of Rubbing Surfaces Against Wear Due to Corrosion (Report No. 2198) 135

13. Rumyantsev, S.V., and L.N. Matsyuk. The Tu^{170}, Eu^{155}, and Ce^{144} as Sources of Radiation for Checking Thin-walled Products (Report No. 2295) 148

14. Bruk, B.I., A.S. Zav'yalov, and G.I. Kapyrin. Studying the Redistribution of Elements in Metal Alloys and Weld Compounds by Autoradiographic and Radiometric Methods (Report No. 2236) 160

15. Gruzin, P.L., A.I. Yevstyukhin, V.S. Yemel'yanov, G.G. Ryabova, G.B. Fedorov. Studying the Diffusion and Distribution of Elements in Alloys of Zirconium and Titanium Base by the Radioactive Isotope Method (Report No. 2526) 172

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14(1)

SOV/67-59-6-1/26

AUTHORS: Malkov, M. P., Doctor of Technical Sciences, Zel'dovich, A. G., Doctor of Technical Sciences, Fradkov, A. B., Candidate of Technical Sciences, Danilov, I. B., Candidate of Technical Sciences

TITLE: Separation of Deuterium From Hydrogen by Means of the Low-temperature Distillation Method

PERIODICAL: Kislorod, 1959, Nr 6, pp 1 - 13 (USSR)

ABSTRACT: The method mentioned in above title proved to be the most suitable and economical one for the production and preparation of deuterium. It was worked out and first applied on a large industrial scale in the USSR. In the present paper, a survey of the present state and problems connected with it in the USSR and abroad is given on the basis of published data. The main schemes of deuterium separation plants are represented and described in figures 1 and 2. The following problems are dealt with: rectification, heat emission, heat insulation, purification of hydrogen from impurities, and realization of the method in industry. There are 15 figures and 27 references, 8 of which are Soviet.

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82005 S/120/60/000/03/048/055
E073/E535

24.2140

AUTHORS: Fradkov, A.B. and Shal'nikov, A.I.

TITLE: Level Indicator for Metallic Liquid Helium Containers

PERIODICAL: Pribory i tekhnika eksperimenta, 1960, No 3, p 148

ABSTRACT: The level indicator operates by utilising the property of tantalum to become superconductive at a temperature only fractions of a degree higher than the boiling temperature of liquid helium at atmospheric pressure. The device consists of a tantalum sensing coil and (in the case of a metallic vessel) a constantan heater which can be pushed into the vessel with a long stainless steel tube. The main feature of the tantalum sensing coil is that at the instant of contact with the liquid helium the tantalum becomes superconductive and the voltage at the coil terminals drops to zero. This instrument operates satisfactorily in transparent or partly transparent vessels in which the temperature gradient is sufficiently pronounced at the surface of the liquid helium. However, in metallic vessels this

Card 1/2 gradient is too small. In order to determine reliably

82005
S/120/60/000/03/048/055
E073/E535

Level Indicator for Metallic Liquid Helium Containers

the location of the liquid boundary, an additional constantan heater is used, the heat dissipation of which (0.07 W) is sufficient to maintain the temperature of the tantalum above the superconductivity point in helium vapour but is not sufficient for doing this when the coil is in contact with the liquid helium. The level indication is accurate to within 1 mm.
There are 1 figure and 2 references, 1 of which is Soviet and 1 English.

ASSOCIATION: Fizicheskiy fakul'tet MGU (Physics Department, Moscow State University)

SUBMITTED: May 4, 1959

Card 2/2

FRADKOV, A.B.; SHAL'NIKOV, A.I.

Level indicator for liquid helium in metal vessels. Prib. i tekh. eksp. no.3:148 My-Je '60. (MIRA 14:10)

1. Fizicheskiy fakul'tet Moskovskogo gosudarstvennogo universiteta.

(Liquid level indicators)
(Helium)

FRADKOV, A.B.

Equipment for conducting low-temperature research with supplied liquid helium. Prib.i tekh.eksp. no.4:126-130 Jl-Ag '60. (MIRA 13:8)

1. Fizicheskiy institut AN SSSR.
(Helium) (Low temperature research)

82520

S/020/60/133/04/20/031
B019/B060

24.5600

AUTHOR: Fradkov, A. B.

TITLE: A Helium Cryostat Without Cooling by Liquid Nitrogen

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol. 133, No. 4, pp. 829-830

TEXT: Liquid nitrogen cooling is generally utilized in the ordinary Dewar vessels used for low-temperature investigations, to avoid heat inflow to the helium. A method is suggested here, in which the heat inflow from the wall to the helium is compensated by the use of cold evaporated gaseous helium. Fig. 1 shows a scheme of this double-walled vessel, featuring a high-vacuum interspace between the walls, which contains shields that at in good thermal contact with the part of the vessel, through which the evaporating helium escapes. A test made with such a cryostat showed that nitrogen cooling can be dispensed with. This cryostat has a 2-liter capacity and is made of copper. It vaporizes 6 g of He per hour. There is 1 figure.

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A Helium Cryostat Without Cooling by Liquid Nitrogen

82520

S/020/60/133/04/20/031
B019/B060

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR (Institute of Physics imeni P. N. Lebedev of the Academy of Sciences, USSR)

PRESENTED: February 27, 1960, by P. L. Kapitsa, Academician

SUBMITTED: February 10, 1960

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PHASE I BOOK EXPLOITATION SOV/5634

Malkov, M. P., A. G. Zel'dovich, A. B. Fradkov, and I. B. Danilov

Vydeleniye deyteriya iz vodoroda metodom glubokogo okhlazhdeniya (Separation of Deuterium From Hydrogen by the Method of Deep Freezing) Moscow, Gosatomizdat, 1961. 150 p. Errata slip inserted. 4,000 copies printed.

Ed.: N. A. Korobtsova; Tech. Ed.: Ye I. Mazel'.

PURPOSE : This book is intended for scientists working on problems of heavy water production, scientific and technical personnel working on deep freezing problems and separation of isotopes, instructors and advanced students.

COVERAGE: The book deals with the physical and technical principles of deuterium separation from hydrogen by the deep freezing method. The specificity of liquid hydrogen rectification is described along with methods for the production of cold at the temperature level of liquid hydrogen. The physicochemical constants of hydrogen isotopes are presented in a form that is easy to use. The material

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is based on works of the individual authors, as well as on works of Soviet and non-Soviet scientists. The tabular data in the appendix are based on the works of non-Soviet scientists. No personalities are mentioned. There are 134 references: 79 English, 35 Soviet, 15 German, 3 French, 1 Czech, and 1 Polish.

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Separation of Deuterium (Cont.) SOV/5634

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JA/dwm/jw
9-29-61

9.5110 (also 1055, 1072, 1137)
5.4800 1043, 1273, 1155

20715

S/120/61/000/001/058/062
E194/E184

AUTHORS: Lotkova, E.N., and Fradkov, A.B.

TITLE: A Metal Cryostat for Optical Investigations of Solid Bodies at Low Temperatures

PERIODICAL: Pribory i tekhnika eksperimenta, 1961, No.1, pp.188-189

TEXT: A metal cryostat with plane parallel windows was developed for optical investigations on solid bodies at low temperatures. In Fig.1, the cylindrical outer casing 1 contains a stainless steel vessel 4 for the cooling liquid (helium or hydrogen). The lower part of the frame contains two windows of 30 mm diameter glazed with KBr or NaCl crystal 6. Thermal insulation of the cryostat is high vacuum developed initially by applying a vacuum pump to the valve 7 in the casing and which is maintained during tests by activated charcoal adsorption. To reduce the inflow of heat by radiation the upper part of the cryostat contains a nitrogen bath 2 and cooling screen 3 which surrounds the inner vessels. The nitrogen bath is suspended from the upper cover of the casing by two thin walled stainless steel tubes through which liquid nitrogen is introduced. The body of the

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S/120/61/000/001/058/062
E194/E184

A Metal Cryostat for Optical Investigations of Solid Bodies at Low Temperatures

cryostat, the nitrogen bath, the screen and the internal vessel are made of copper with carefully polished surface. Particular care must be taken in making joints in the apparatus. To replace specimens the lower part of the frame and the screen are made removable. A solid specimen of 25 x 10 x 2 mm is fixed with adhesive to the flat end of the cold line 5 with an aperture of 20 x 5 mm^2 for illumination. With this method of fixing the temperature of the sample without illumination is 14 °K and with illumination 18 °K. It is most important to have good contact between the solid specimen and the cold line. Various precautions that must be taken in practice are described. Liquid helium can be kept in the cryostat for 8 hours with a mean rate of evaporation of 2 litres/min. Liquid hydrogen is maintained for 72 hours at an evaporation rate of 0.2 litres per minute of gas. Because it is made of metal and does not need continuous pumping, the cryostat is convenient and safe.
There is 1 figure.
Card 2/4

20715

S/120/61/000/001/058/062
E194/E184

A Metal Cryostat for Optical Investigations of Solid Bodies at Low Temperatures

ASSOCIATION: Fizicheskiy institut AN SSSR
(Physics Institute, AS USSR)

SUBMITTED: January 21, 1960

Card 3/4

FRADKOV, A.B.

Helium and hydrogen cryostats without an additional cooling with liquid nitrogen. Prib. i tekh.eksp. 6 no.4:170-173 Jl-Ag '61. (MIRA 14:9)

1. Fizicheskiy institut AN SSSR.
(Cryostat)

L 10721-65 EWG(d)/EWT(...)/EPA(s)-2/EWT(m)/EWP(w)/EPF(c)/EEC(k)-2/EPF(n)-2/EWG(v)/EWA(c)/EPR/EPA(w)-2/T/EWP(c)/EWG(c)/EWG(h) Pe-4/Pab-10/Pe-5/Pr-4/Ps-4/Pt-7/Pu-4 IJP(c) JD/WW/RW/RM

ACCESSION NR AM4041624 BOOK EXPLOITATION S/ 72 70 B+1

Malkov, Mikhail Petrovich (Professor); Danilov, I. B.; Zel'dovich, A. G.; Fradkov, A. B.

Handbook on the physical and technical bases of deep cold (Spravochnik po fiziko-tekhnicheskim osnovam glubokogo okhlazhdeniya), Moscow, Gosenergoizdat, 1963, 416 p. illus., biblio., diagrs., index. Errata slip inserted. 14,000 copies printed.

16 21

TOPIC TAGS: cryogenic engineering, cryogenic equipment, thermodynamics, carbon steel, low alloy steel, austenitic steel, nonferrous metal, weldment, insulation, hydraulics, gas

PURPOSE AND COVERAGE: This handbook gives the basic physical-chemical constants, thermodynamic and thermal engineering relationships, and production indicators required for calculating and designing deep cold equipment and in research in low-temperature physics. The book describes typical schemes of gas liquefaction and separation of gaseous mixtures. The theory of the processes is included. The handbook is intended as an aid for engineers and researchers; it can also serve as a textbook for students in advanced courses specializing in low-temperature physics and engineering.

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TABLE OF CONTENTS (abridged):

L 47721-65
ACCESSION NR AM4041624

Subject Index -- 412

SUBMITTED: 02Sep63 SUB CODE: OP

NO REF SOV: 543 OTHER: 999

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FRADKOV, A.B.

Production and use of liquid neon on a laboratory scale. Prib. i tekh. eksp. 8 no.1:184-185 Ja-F '63. (MIRA 16:5)

1. Fizicheskiy institut AN SSSR.
(Liquefied gases)

ACCESSION NR: AP4018402 S/0120/64/000/001/0233/0235

AUTHOR: Fradkov, A. B.; Troitskiy, V. F.

TITLE: Hydrogen liquefier with a two-stage conversion for producing 98% para-hydrogen

SOURCE: Pribory* i tekhnika eksperimenta, no. 1, 1964, 233-235

TOPIC TAGS: para hydrogen, hydrogen liquefier, two stage conversion liquefier, hydrogen liquefaction, VOS-3 hydrogen liquefier, para hydrogen liquefier

ABSTRACT: A new para-hydrogen liquefier is described in which the cooling cycle is based on the Joule-Thomson effect in normal hydrogen. A cooling down to the 21K level is effected in a closed cycle with throttling normal hydrogen precooled by liquid nitrogen. The para-hydrogen producing line is separate from the principal cooling cycle,which makes the outfit multipurpose (liquefaction of deuterium or neon is possible). The ortho-para conversion of hydrogen is conducted at two temperature levels: (a) at the liquid-nitrogen

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ACCESSION NR: AP4018402

temperature and (b) at the liquid-hydrogen temperature. Machine equipment and assemblies of the standard VOS-3 hydrogen liquefier have been used in the new outfit (see Enclosure 1). The new liquefier was tested with two compressors with 70 m^3/hr combined output at 110-125 atm. With 70K in the nitrogen bath (260 torr), the output was 16.5 lit/hr of normal hydrogen or 12.5 lit/hr of para-hydrogen; starting time, 25 min. After the first conversion stage, the gas contains 46% of para-H ; after the second stage, 95-98%. "Assembly and alignment of the liquefier were done by L. A. Bolotin, I. S. Bocharov, and A. S. Gribov." Orig. art. has: 2 figures.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva AN SSSR (Institute of Physics, AN SSSR)

SUBMITTED: 15Jan63 DATE ACQ: 18Mar64 ENCL: 01

SUB CODE: PH NO REF SOV: 005 OTHER: 001

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L 27740-66 EWT(l)/EWT(m)/EPF(n)-2/EWP(t)/ETI/ETC(m)-6 IJP(c) JD/WW/JG

ACC NR: AP6001599 SOURCE CODE: UR/0120/65/000/006/0215/0216

AUTHOR: Fradkov, A. B.

ORG: Institute of Physics of AN SSSR, Moscow (Fizicheskiy Institut)

TITLE: Cryostats for superconducting solenoids with a warm working space

SOURCE: Pribory i tekhnika eksperimenta, no. 6, 1965, 215-216

TOPIC TAGS: superconductivity, cryostat, solenoid

ABSTRACT: Experiments with two types of cryostats designed by the Cryogenics Department of the Institute of Physics in Moscow are discussed. The cryostats were made of metal with a liquid helium bath carrying a superconducting solenoid. The solenoid was immersed vertically in the first type of cryostat while in the second version it was placed in a horizontal position. Both types were schematically shown in a diagram. They were similar to the cryostats described by A. B. Fradkov (PTE, 1960, no. 4, 126). The solenoid windings were made of niobium-zirconium wire (d = 0.2 mm; type RNC-3 with 33% of Zn). Critical current was 12 to 15 amp. Magnetic field strength in the center of solenoids was 15 koe for the first version and 25.8 koe for the second one. The average evaporation of helium was 200 nl/hr (first version)

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L 27740-66

ACC NR: AP6001599

3

and 50 nl/hr (second version). An amount of 40 to 45% of the solenoid energy was spent on the evaporation of liquid helium in the case of a sudden transition from the superconducting state to normal conditions.

Gratitude is expressed to I. Yu. Shebalin, V. F. Troitskiy and N. V. Baryshev for their participation in designing and testing the cryostats and solenoids. Orig. art. has: 1 figure.

SUB CODE: 20 / SUBM DATE: 24June64 / ORIG REF: 001 / OTH REF: 001

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L 38540-66 EWT(m)/T/EWP(t)/ETI IJP(c) JD/GD

ACC NR: AT6014759 SOURCE CODE: UR/0000/65/000/000/0110/0114

AUTHOR: Fradkov, A. B.

ORG: none

TITLE: Metallic crystals for superconducting solenoids

SOURCE: Soveshchaniye po metallovedeniyu i metallofizike sverkhprovodnikov, 1st, 1964. Metallovedeniye i metallofizika sverkhprovodnikov (Metallography and physics of metals in superconductors); trudy soveshchaniya. Moscow, Izd-vo Nauka, 1965, 110-114

TOPIC TAGS: cryogenics, cryostat, superconducting alloy, solder, copper plate, stainless steel, ~~experimental method~~, magnetic field/ MZ-copper plate, 1Kh18N9T stainless steel, POS-50 solder, PSr-45 solder, KR-22 cryostat, KR-27 cryostat

ABSTRACT: The construction details of several cryostats are discussed. These were prepared in the Cryogenics Branch, Institute of Physics, AN SSSR (Kriogennyy otdel Fizicheskiy institut AN SSSR). One of the cryostats is built to accommodate the solenoid as well as the test area within the helium-cooled cryostat. The other two have their test sections exposed to room temperature. The basic parts of all three cryostats are made of copper tubing and have an outer compartment filled with liquid nitrogen and an inner compartment filled with liquid helium. These compartments are made of stainless steel. An overall heat balance indicates that the total heat

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ACC NR: AT6014759

leakage into the system amounts to 560 joules/hour. A single-section solenoid placed in one of those cryostats can generate a field of 15 koe in a 52 mm gap with a critical current of 14--17 amps. It is contended that the above system is capable of yielding 50--60 koe magnetic fields. The author expresses his thanks to I. Yu. Shebalin and V. F. Troitskiy for participating in the cryostat experiments. Orig. art. has: 5 formulas and 3 figures.

SUB CODE: 20/ SUBM DATE: 23Dec65/ ORIG REF: 004

Card 2/2

FRADKOV, G.

LEVIN, I.; FRADKOV, G.

Accounting for goods in wholesale warehouses. Bukhg.uchet 14 no.7:25-33 Jl '57. (MLRA 10:7)
(Kharkov Province--Warehouses--Accounting)

LEVIN, I.; FRADKOV, G. (Khar'kov).

Improve accounting for goods purchased, goods delivered, and payments from purchasers and suppliers at wholesale trade depots. Bukhg. uchet 15 no.2:58-63 F '58. (MIRA 11:3)
(Kharkov Province--Wholesale trade--Accounting)

FRADKOV, S. S.

"Questions Pertaining to Flight in Jet Propelled Aircraft"

Vestnik Vozdushnovo Flota (Air Force Herald), #7, July, 1946

In the above report this publication was cited, without translation, as a possible source of further information on aviation medical research. This was in connection with an announcement that Lt. Col. Basharin, Lt. Col. Grayfer, and Capt. Kalugin, staff physicians at the Central Sci. Res. Aviation Hospital* [redacted] were concerned with experiments in the establishment of "resistance to altitude by men who had suffered fractured skulls accompanied by loss of consciousness." D. Novak's "Peculiarities of Flight at Great Altitudes" was also cited, without translation, as another possible source.

*Moscow

FRADKOV, Ye.; YUSFIN, B.

Establishing consolidated norms in piece and small-lot production. Sots. trud 5 no.6:85-89 Je '60. (MIRA 13:11)
(Machinery industry--Production standards)

BOGUSLAVSKIY, I.Ya.; FRADKOV, Ye.S.

Organization of the dispatcher service and operational accounting in a machine shop. Biul.tekh.-ekon.inform.Gos.nauch.-issl.inst.nauch.i tekh.inform. no.12:65-69 '63. (MIRA 17:3)

FRAILIN, B. N.

35178. Klassifikatsiya Traektoriy Material'Noytochki, Nakhodyashcheysya Pod Deystviem Tsentral'Noy Sily, ZavisyashcheyTol'ko ot Rasstoyaniya. (Iz Kand. Dissertatsii) V SB:50 Let Kievsk. Politekhn. In-Ta. Kiev, 1948, s. 607-13

SO: Letopis' Zhurnal'Nykh Statey, Vol. 48, Moskva, 1949

FRADLIN, B.N.

Singular trajecteries infinitely removed in the generalized theory of two bodies. Nauk.zap.Kiev.un.11 no.7:105-110 '52. (MLRA 9:10)
(Problem of two bodies)

[illegible], M. F.

"Special Trajectories of Impact in the General Two-body Problem" Izv. Kievsk. Politekhn. in-ta, Vol 12, 1953, pp 25-34

The author discusses the dynamic problem of the motion of a material point under the action of a central force. The differential equations of motion in polar coordinates (r,θ) have the form

$$r - r\dot{\theta}^2 = f(r), \quad \frac{d}{dt}(r^2\dot{\theta}) = 0.$$

A few of the author's conclusions are incorrect, but they do not destroy the value of the article. (RZhMat, No 2, 1955)

SO: Sum. 492, 12 May 55

SOV/124-57-4-4972

Translation from: Referativnyy zhurnal. Mekhanika, 1957, Nr 4, p 146 (USSR)

AUTHOR: Fradlin, B. N., Shakhnovskiy, S. M.

TITLE: On the Stressed State of Initially-distorted Slender Rods (O napryazhennom sostoyanii pervonachal'no iskrivlennykh tonkikh sterzhney)

PERIODICAL: Izv. Kiyevsk. politekhn. in-ta, 1955, Vol 18, pp 42-52

ABSTRACT: On the basis of the results of the design calculation of a paddle wheel as a whole, the authors investigate the stresses in struts which arise in the strut junction constraints. The theory of the equilibrium of slender elastic rods serves as a basis for the calculations. The paper shows the considerable effect of the distortion of the struts on the local stress distribution. Such a localized stress rise may be one of the reasons for the failure of struts.

N. A. Kil'chevskiy

Card 1/1

PUTYATA, T.V.; FRADLIN, B.N.

IUrii Dmitrievich Sokolov; on the 60th anniversary of his birth. Ukr.mat.zhur. 8 no.2:223-230 '56. (MLRA 9:8)
(Sokolov, IUrii Dmitrievich, 1896-)
(Bibliography--Mathematics)

AUTHORS: Fradlin, B.N. and Shakhnovskiy, S.M SOV-21-58-4-6/29

TITLE: On Obtaining Integro-Differential Equations for the Equilibrium of Inclined Shells (O sostavlenii integro-differentsial'nykh uravneniy ravnovesiya pologikh obolochek)

PERIODICAL: Dopovidi Akademii nauk Ukrains'koi RSR, 1958, Nr 4, pp 381-385 (USSR)

ABSTRACT: Applying N.A. Kil'chevskiy's method [Ref. 1,2] the authors reduce the problem of the equilibrium of a gently inclined shell, subjected to an arbitrary load, to a system of functional equations which looks as follows

$$U_{(i)\alpha}(M,N) = V_{(i)\alpha}(M,N) - \iint_{(s)} \left[K^{j}_{(\alpha)}(Q,M) U_{(i)j}(Q,N) + L^{j}_{(\alpha)}(Q,M) \omega_{(i)j}(Q,N) \right] d S_Q - A_{(i)\alpha}(M,N) + A'_{(i)\alpha}(M,N) \qquad (1)$$

where $\omega_{(i)\alpha}$ are components of the vector of an elementary turn around point M induced by a corresponding unitary force applied to point N; $A_{(i)\alpha}(M,N)$ is the work of auxiliary efforts $T^{\sigma}_{\mu}(V_{(i)\alpha})$ and moments $M^{\sigma}_{\mu}(V_{(i)\alpha})$ applied to the periphery of the middle surface of the shell, on the main displacements; $A'_{(i)\alpha}(M,N)$ is the work of main efforts

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